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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/791,461	03/01/2004	Henry L. Edwards	TI-37042	2105
23494	7590	07/19/2005	EXAMINER	
TEXAS INSTRUMENTS INCORPORATED P O BOX 655474, M/S 3999 DALLAS, TX 75265			SARKAR, ASOK K	
			ART UNIT	PAPER NUMBER
			2891	

DATE MAILED: 07/19/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/791,461	Applicant(s) EDWARDS ET AL.	
	Examiner Asok K. Sarkar	Art Unit 2891	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 March 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-52 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-52 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 01 June 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1, 3, 8, 12 – 14, 17, 21, 25, 33, 38 – 40 and 48 are rejected under 35 U.S.C. 102(b) as being anticipated by Takahashi, US 4,900,695.

Regarding claims 1, 12, 25 and 38, Takahashi teaches a method of integrated circuit repair comprising:

- forming a top dielectric layer 6 over said integrated circuit (see Fig. 13);
- removing the top dielectric layer in at least one location 7a using a FIB (see Fig. 13) in column 5, lines 45 – 50 and in column 11, lines 15 – 20;
- etching exposed areas of a top metal layer 5a using a wet chemistry process in column 11, lines 27 – 35 (see Fig. 14);
- etching selected portions of one or more dielectric interconnect layers 4 using a FIB in column 12, lines 6 – 12 (see Fig. 15);
- etching selected portions of a metal interconnect 3a using a FIB in column 10, lines 23 – 40 (see Fig. 12); and
- coupling a first metal interconnect portion 7a to a second metal interconnect portion 7b using a FIB in column 12 lines 16 – 20 using the FIB apparatus of Fig. 6 as described in column 7, lines 8 – 40 (see Figs. 10 and 12).

Regarding claims 2 and 16, Takahashi teaches top dielectric layer 6 is a protective layer as shown in Fig. 2.

Regarding claims 3 and 17, Takahashi teaches top metal layer 5a, 5b is a power bus layer in column 10, lines 35 – 42 with reference to Fig. 12.

Regarding claims 8, 21, 33 and 48, Takahashi teaches wet chemistry using nitric acid in column 11, line 62.

Regarding claims 13, 14, 39 and 40, Takahashi teaches first metal interconnect portion and the second metal interconnect portion are located in the same or different metal interconnect layer with reference to Figs. 12 and 17.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of

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the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 9 – 11, 22 – 24, 35 – 37 and 50 – 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takahashi, US 4,900,695 in view of Ye, US 6,534,416.

Regarding claims 11, 24, 37 and 52 have been described earlier in rejecting claims 1, 12, 25 and 38 by Takahashi. However, Takahashi fails to teach etching exposed areas of a top metal layer 5a using a plasma etch process.

Ye teaches plasma etching of metal layers for the benefits of providing desired feature dimension and integrity in the abstract of his disclosure.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Takahashi and use plasma etching of metal layers for the benefits of providing desired feature dimension and integrity as taught by Ye in the abstract of his disclosure.

Regarding claims 9,10, 22, 23, 35, 36, 50 and 51, Takahashi teaches Al layer, but fails to teach copper as the top metal layer and the metal interconnect layer.

Ye teaches copper as the choicest metal for metal lines in present day integrated circuits for the benefit of providing ease of fabrication and gate velocity in column 1, lines 19 – 30.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Takahashi and use copper as the top metal layer and the metal interconnect layer for the benefit of providing ease of fabrication and gate velocity as taught by Ye in column 1, lines 19 – 30.

7. Claims 4, 7, 18, 19, 29, 30, 32, 45 and 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takahashi, US 4,900,695 in view of Casey, US 6,042,738.

Takahashi fails to teach removing dielectric layers from top and interconnect portions and metal interconnect portions using a FIB that includes the use of a Gallium LMI source and Xenon DiFluoride gas.

Casey teaches the use of FIB that includes the use of a Gallium LMI source and Xenon DiFluoride gas in column 4, lines 44 – 64 and in column 7, lines 1 – 5 for the benefit of removal of portions from a workpiece having opaque film patterned on it in column 2, lines 29 – 32.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Takahashi and use FIB that includes the use of a Gallium LMI source and Xenon DiFluoride gas for the benefit of removal of portions from a workpiece having opaque film patterned on it as taught by Casey in column 2, lines 29 – 32.

8. Claims 6, 20, 31 and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takahashi, US 4,900,695.

Takahashi fails to teach wet chemistry process using a hood.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Takahashi and use a hood for the wet chemistry because the nitric acid used for etching gives off toxic vapor that can be safely handled inside a properly ventilated hood system.

9. Claims 15 and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takahashi, US 4,900,695 in view of Novotony, US 6,847,907.

Takahashi fails to teach coupling metal interconnects portions using a FIB that includes the use of a Gallium LMI source and platinum gas.

Novotony teaches a method of coupling metal lines using a FIB that includes the use of a Gallium LMI source (see column 13, lines 63 – 67) and platinum gas (see column 20, lines 39 – 43) for the benefit of providing a system that can detect and repair electrical defects.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Takahashi and use a FIB that includes the use of a Gallium LMI source and platinum gas for coupling metal interconnects portions since the same FIM system can be used for both drilling as well as deposition as Takahashi does with other metals.

10. Claims 28 and 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takahashi, US 4,900,695 in view of Saran, US 6,232,662.

Takahashi fails to teach the top metal layer as a BOAC layer.

Saran teaches BOAC layer for the integrated circuit chips for the benefit of providing a low cost production system in column 3, lines 1 – 15.

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Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Takahashi and use the top metal layer as a BOAC layer for the benefit of providing a low cost production system as taught by Saran in column 3, lines 1 – 15.

11. Claims 26, 27, 34, 42, 43 and 49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takahashi, US 4,900,695 in view of Crawford, US 2002/0173148.

Takahashi teaches the top dielectric layer as an insulating layer, but fails to teach that the layer is silicon nitride and is formed by a PVD or a CVD process.

Crawford teaches the deposition of a nitride layer as a protective barrier layer for the benefit of using the layer for FIB drilling in paragraphs 21 and 22.

Therefore, it would have been obvious to one with ordinary skill in the art at the time of the invention to modify Takahashi and use the nitride layer as a protective barrier layer for the benefit of using the layer for FIB drilling as taught by Crawford in paragraphs 21 and 22.

It would have been obvious to one with ordinary skill in the art at the time of the invention to use either a PVD or a CVD process for the deposition of the nitride barrier layer since these processes are well known in the art of layer deposition.

Conclusion

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Asok K. Sarkar whose telephone number is 571 272 1970. The examiner can normally be reached on Monday - Friday (8 AM- 5 PM).

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, William B. Baumeister can be reached on 571 272 1722. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

13. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Asok K. Sarkar

July 14, 2005

Primary Examiner